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# MADROÑO

## A WEST AMERICAN JOURNAL OF BOTANY

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# MADROÑO

## A WEST AMERICAN JOURNAL OF BOTANY

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# VIGETHIA, A NEW GENUS OF COMPOSITAE BASED ON WYETHIA MEXICANA WATSON

William A. Weber

Current studies in the genus *Wyethia* (Compositae) reveal that the entity hitherto called *Wyethia mexicana* Watson differs from the other species of this genus in a number of important characters which are believed to be of generic value. Indeed, Watson expressed his own doubts as to its affinities when, in the original description, he noted that the plant was "rather abnormal in habit and involucre." The presence of fertile ray flowers and alternate leaves may have been prime considerations in deciding the issue, but entirely too much emphasis seems to have been placed upon a single character (that of the pappus) the taxonomic value of which had not been established. Watson placed the species in *Wyethia* with the remark that "the achene, though small, and pappus are wholly those of [that] genus." The real status of *Wyethia mexicana* has since remained obscure because of its great rarity and because a comprehensive study of *Wyethia* has never been made.

The hiatus between *Wyethia mexicana* and the 14 species comprising the remainder of the genus is much greater than that between any other two species. *Wyethia mexicana* is a sub-shrub 3 to 5 feet tall; all other *Wyethia* species are, at most, perennial herbs. The leaves of *Wyethia mexicana* are regularly crenate-dentate; those of other wyethias are entire or only sparsely and irregularly serrate-dentate. The stems of *Wyethia mexicana* are branched, while the stems of other wyethias are simple to the inflorescence. The roots of *Wyethia mexicana* are shallow, spreading and woody; those of other wyethias are deep, cylindric, vertical and fleshy. The achenes of *Wyethia mexicana* are only 3 mm. long exclusive of the pappus, while the achenes of other wyethias are never less than 6 mm. long and may be as long as 15 mm. Finally, no other *Wyethia* species are known to occur south of northern Lower California and northeastern Arizona.

These differences are so striking that in view of our present knowledge of the genus *Wyethia* it seems best to exclude *Wyethia mexicana* from that natural group. With a few exceptions, the characteristics which mark this species could more logically place it in *Viguiera*. However, it differs from *Viguiera* and its relatives in having pistillate ray flowers and alternate leaves, characters which are also believed to be of generic value. Since *Wyethia mexicana* apparently cannot be included in these or in any other established genus, it appears desirable to propose a new genus based on this entity, to occupy a systematic position between *Viguiera* and *Wyethia*.

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Madroño, Vol. 7, pp. 97–128. October 14, 1943.

**Vigethia** gen. nov. Plantae suffruticosae ramosae foliis alternis ovatis crenato-dentatis triplinerviis. Capitula mediocris magnitudinis, heterogama, radiata, floribus radii ♀ 1-seriatis discique ☿ fertilibus. Involucrum hemisphaericum, bracteis 2–3-seriatis parum inequalibus, apice laxis squarrosisve discum haud superante. Receptaculum planum vel convexiusculum, paleis complicatis flores disci amplectentibus onustum. Corollae radii ligulatae patentes integrae vel minute 1–2-dentatae discique regulares tubo brevi limbo elongato cylindraceo apice breviter 5-fido. Antherae basi subsagittatae. Styli rami appendicimis longis hirtis terminati. Achaenia parva, disci quadrangulo-prismatica, radii compressiuscula, plus minus triangulata breve coronata. Squamellae patentes persistentes 3–4 glabrae coriaceae basibus coalitae.

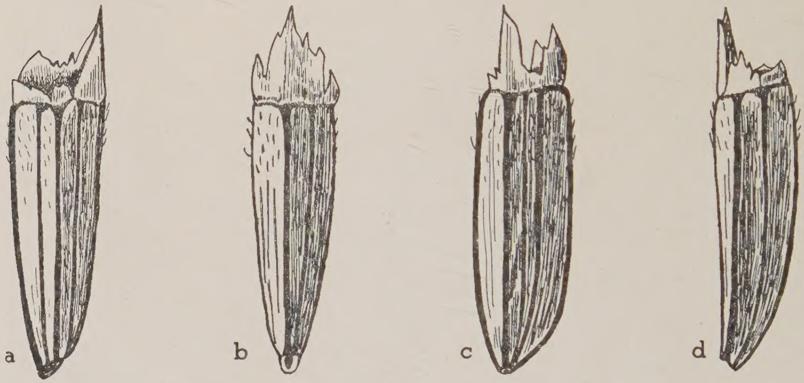

Fig. 1. Achenes of *Vigethia:* a, disk achene, lateral view; b, disk achene, ventral view; c, ray achene, ventral view; d, ray achene, lateral view. (× 15.)

**Vigethia mexicana** (S. Wats.) comb. nov. Species typica. *Wyethia mexicana* S. Watson in Proc. Am. Acad. 25: 154. 1890.

Sub-shrub, 1 to 1.6 meters high. Root system shallow, the roots coarse, stout, woody. Branches of the year striate, spreading hirsute, older branches glabrate. Leaves alternate, lance-ovate to subcordate, 6 to 10 cm. long, regularly crenate-dentate, green and appressed-hirsute above, cinereous-subtomentose beneath, conspicuously triple-nerved, with petioles one-fourth to one-third the length of the blades. Heads few, 1.5 to 2.5 cm. wide. Involucre hemisphaerical, about 3-seriate, the phyllaries lanceolate, pubescent and densely ciliate, with squarrose, attenuate tips. Paleae lance-linear with pubescent, dilated apices. Flowers yellow, the ample rays twice as long as the disk, pubescent and minutely resinous-dotted on the tube and back, styliferous and bearing 4 to 5 staminodia, the disk flowers glabrous except for the pubescent lobes. Achenes black, minute, 2.5 to 3 mm. long exclusive of the pappus, sparsely appressed-pubescent

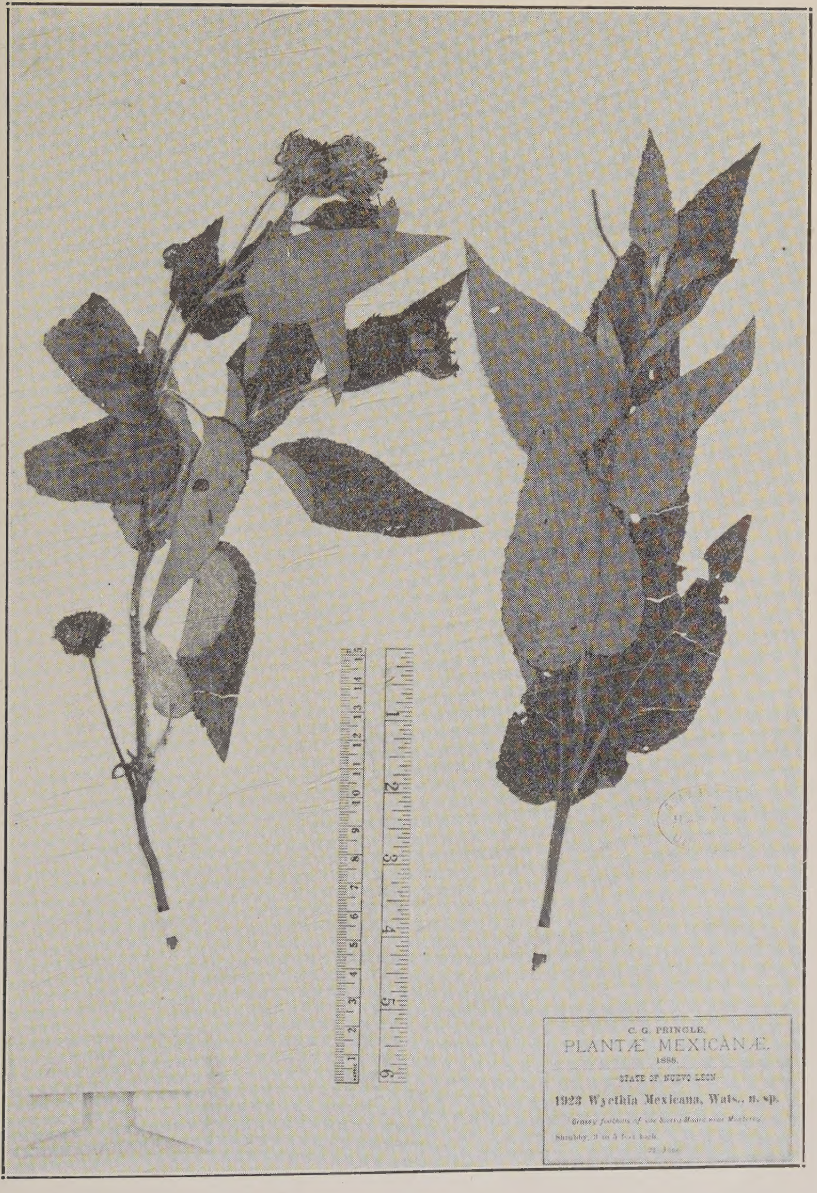
C. G. PRINGLE.
PLANTÆ MEXICANÆ.
1888.
STATE OF NUEVO LEON
1923 Wyethia Mexicana, Wats., n. sp.
Shrubby, 3 to 5 feet high.

PLATE 20. VIGETHIA MEXICANA (S. Wats.) comb. nov. Photograph of type. (Gray Herbarium, Harvard University.)

on the upper half. Pappus light-colored, one-fourth to one-third the length of the achene.

Range. Known only from the type locality, foothills of the Sierra Madre near Monterrey, Nuevo Leon, Mexico.

Specimens examined. Mexico. Nuevo Leon: Monterrey, San Agustin, 600 meters altitude, July 1, 1911, *Bro. Abbon 145* (United States National Herbarium); grassy foothills of the Sierra Madre near Monterey [*sic*], June 22, 1888, *C. G. Pringle 1923* (Gray Herbarium, type; University of California; United States National Herbarium), June 10, 1889, *2704* (Missouri Botanical Garden; University of California); near Monterrey, 540 meters altitude, May 26, 1908, *C. G. Pringle 15616* (United States National Herbarium); Hacienda Vista Hermosa, 35 miles south of Monterrey, 705 meters altitude, June 29, 1939, *Stephen S. White 1624* (Gray Herbarium); above Horsetail Falls, Villa de Santiago, 750 meters altitude, June 18, 1940, *W. C. Leavenworth 104* (Missouri Botanical Garden; New York Botanical Garden).

Department of Botany,
State College of Washington, Pullman,
August, 1943.

## A REVISION OF THE GENUS FREMONTIA

Margaret Harvey

The study of the genus *Fremontia* (Sterculiaceae) was suggested to me by Dr. Philip A. Munz of Pomona College to whom I am greatly indebted for guidance and assistance. I wish to express my appreciation to Dr. Charles A. Weatherby of Gray Herbarium for help on the problem of nomenclature and to thank the curators of the following herbaria for kindly lending material which has been used in the preparation of this paper, especially Miss Alice Eastwood who generously lent type specimens from the California Academy of Sciences. The abbreviations indicated are those used in citing specimens: California Academy of Sciences (CAS); Dudley Herbarium, Stanford University (DS); University of California at Los Angeles (LA); New York Botanical Garden (NY); Pomona College (POM); Rancho Santa Ana Botanical Garden (RSA); San Diego Museum of Natural History (SD); University of California (UC).

The genus *Fremontia* was first collected by Colonel J. C. Fremont during his expedition to California from 1845 to 1847 and named and described in 1854 by John Torrey who thus commemorated the explorer for his valuable services to North American botany. An interesting and somewhat complicating situation existed at the time this genus was named in that the generic name *Fremontia* was first applied by Torrey (Fremont, First Rep., p.

95. 1845) to the plant now known as *Sarcobatus vermiculatus*, but the name *Sarcobatus* had already been given to the genus by Nees von Esenbeck, and *Fremontia* was thus a later homonym as applied to *Sarcobatus*. In naming the sterculiaceous genus *Fremontia*, Torrey mentioned the invalidity of the name as first applied and although he himself was responsible for conferring the name *Fremontia* upon two completely different groups, he attempted to clear up the situation and prevent further confusion.

Baillon (Hist. Pl. 4: 70. 1873) has referred the later *Fremontia*, our plant, to a Mexican genus, *Cheiranthodendron* Benth. & Hook. f. (*Chiranthodendron* Cerv.), an older name for *Cheirostemon* Humb. & Bonpl. (*Chirostemum* Cerv.), but Torrey, in publishing the genus as *Fremontia* also knew the genus *Cheirostemon* and pointed out some of the differences. Dr. Gray in one of his later papers (Proc. Amer. Acad. 22: 304. 1887) considered the two genera distinct. Perfect flowers without petals bind together *Fremontia* and *Cheirostemon*, but the zygomorphic flowers and sessile anthers of *Cheirostemon* would seem sufficient to separate it from *Fremontia*.

Coville, in the Death Valley Expedition botanical report (Contrib. U. S. Nat. Herb. 4: 74. 1893), proposed the name *Fremontodendron* to replace *Fremontia*, which he held to be untenable. When the specific name "mexicana" was published in 1917 by Davidson, it was in the combination *Fremontodendron mexicanum*. According to Article 61 of the 1935 International Rules, "a name of a taxonomic group is illegitimate and must be rejected if it is a later homonym . . . even if the earlier homonym is illegitimate . . ." and technically *Fremontodendron* should be adopted. The matter of later generic homonyms was referred by the Congress of 1930 to a committee for investigation and report. The names concerned were taken up alphabetically and report was duly made to the Amsterdam Congress on the letters which had been finished and a list of conserved names published (Kew Bull. Miscel. Inf. p. 81. 1940). The letters F to L were not finished in time for the Congress; technically these are still under consideration by the committee and it might be argued that until its report is made, names like *Fremontia* are likely to be conserved and therefore may be retained, even though technically illegitimate. Since *Fremontia* is the name now used by a majority of western taxonomists, it seems wise to await the results of the investigating committee before making any further changes as to nomenclature.

There has been no previous comprehensive study of the genus as a whole. For more than sixty years following the first description of the genus by Torrey it remained monotypic, until the quite distinct *Fremontodendron mexicanum* was described by Davidson (Bull. So. Calif. Acad. Sci. 16: 50. 1917). No further work was done until Eastwood described three new species in 1934 (Leaflets West. Bot. 1: 139–140).

Several characters have been used in delimiting species of this genus. The basal pits of the calyx lobes in *F. mexicana* are devoid of hairs; in other species the glands are usually densely hairy. *Fremontia napensis* differs from other species in its smaller flowers, smaller leaves and more slender twigs. *Fremontia crassifolia* may be separated from the *F. californica-F. obispoensis* group by the thick, conspicuously three-veined leaves and matted tomentum. Other fairly reliable characters are shape of capsules, size and color of flowers, leaf outline and pubescence.

The species of this genus present an interesting geographical problem: the most restricted and the most distinct species all occur in the coastal mountain ranges of California and Baja California, whereas the polymorphic *F. californica* complex is found growing in the foothills of the hotter and drier inland mountains. One would expect *Fremontia* to occur on one or another of the islands off the coast of southern California but as far as can be ascertained, no report has ever been made of its existence there.

## SYSTEMATIC TREATMENT

FREMONTIA Torrey, Smithson. Contrib. 6 (Pl. Fremont.): 5, t. 2. 1854. Not *Fremontia* Torr. in Fremont First Rep., p. 95. 1843. *Fremontodendron* Coville, Contrib. U. S. Nat. Herb. 4: 74. 1893. *Cheiranthodendron* Benth. & Hook. f. of Baillon, Hist. Pl. 4: 127. 1873, in part. *Cheirostemon* Humb. & Bonpl. of Index Kewensis in error (in part).

Evergreen shrubs or small trees with stellate pubescence and mucilaginous inner bark. Leaves simple, alternate. Flowers bisexual, actinomorphic, large and showy. Calyx petaloid, open-campanulate, 5-lobed to below the middle, slightly imbricate, stellate-pubescent externally, villous internally with five pits at the base of the lobes. Petals none. Stamens 5, alternate with the sepals, joined by their filaments for about one-half their length. Ovary superior, 4- or 5-celled, surrounded by the base of the filament tube; style filiform, exserted beyond the stamens. Fruit a densely bristly-hairy capsule, 4- or 5-valved, dehiscent from the apex, persisting for many months; seeds dark, 2 or 3 in each cell.

Type species. *Fremontia californica* Torrey.

### KEY TO SPECIES

Pits at base of calyx lobes usually densely hairy.
  Flowers small, not over 3.5 cm. in diameter, yellow, often rose-tinged; flowering twigs slender, 2–3 mm. thick; leaves small, less than 2 cm. long, with pubescence on the lower surfaces not matted; capsules conical. Napa and Lake counties .............................. 1. *F. napensis*

Flowers more than 4 cm. in diameter, clear yellow.
  Leaves thick, heavy, 2.5–4 cm. long, the upper surfaces conspicuously 3-veined, almost smooth above; thick matted tomentum present on stems, petioles, lower leaf surfaces; flowers large, almost 6 cm. in diameter. Coast Ranges, central California ............ 2. *F. crassifolia*
  Leaves thin, upper surfaces inconspicuously veined; thick tomentum not present; flowers usually 3.5–5 cm. in diameter.
    Flowering twigs slender, 2–3 mm. thick; capsule ovoid, acuminate, the length at least twice the diameter; leaves prevailingly entire. San Luis Obispo County ........................................ 3. *F. obispoensis*
    Flowering twigs thicker, 3–5 mm. thick, capsule ovoid, little longer than thick. Mountain slopes of California ........................................ 4. *F. californica*
Pits at base of calyx lobes glabrous; leaves thick, heavy, conspicuously 5-veined; flowers large, 6–7 cm. in diameter, orange. San Diego County south into Baja California 5. *F. mexicana*

1. Fremontia napensis Eastwood, Leaflets West. Bot. 1: 140. 1934. *F. californica* Torr. var. *napensis* (Eastw.) McMinn, Ill. Man. Calif. Shrubs, 355. 1939.

Shrub, 2–3 meters high, spreading from the base; flowering twigs slender, 1–3 mm. thick, reddish brown, the young growing tips stellate-tomentose; leaves small, thin; blades entire or slightly sinuate to somewhat 3- to 5-lobed, 1–2 (2.5) cm. long, 0.7–1.5 cm. broad, dull or dark green above with few scattered stellate hairs; mature leaves light green below with whitish pubescence, not matted, becoming ferruginous; calyx yellow, sometimes rose-tinged, small, 3–3.5 cm. in diameter; capsule conical, 1.5 cm. long and about 1.5 cm. in diameter at the base.

Locally frequent on chaparral-covered slopes of Napa County and north into Lake County, California. Flowering period, May. Representative material. Lake County: Mirabel Mine, *Eastwood & Howell 5533* (CAS, DS, NY, POM, RSA, UC). Napa County: 15.9 miles southeast Lower Lake, *J. Clausen 1061* (DS, NY, POM, UC); 4 miles north Knoxville Mines, *Mason 10009* (CAS, DS, LA, NY, POM, RSA, UC); Hunting Creek, *Howell 14653* (CAS, DS, LA, NY, POM, RSA, UC); Knoxville, *C. F. Baker 2972* (CAS, NY, POM, UC); north side Mount St. Helena, 1926, *Hobson* (CAS, type).

This species is easily distinguished by the small flowers, the small rather thin leaves and slender branches, and is amply distinct to merit specific rank, being one of the most clear-cut entities of the genus. An interesting specimen which appears to belong to this group has been collected at Pipe Creek, Hemet Valley, Riverside County (*Munz 5805*, POM, UC). As this locality represents the southernmost limit of a number of other northern species, it may well be that this specimen should be referred to *F. napensis*.

2. **Fremontia crassifolia** Eastwood, Leaflets West. Bot. 1: 139. 1934.

Shrub, 2–3 meters high, twigs thick and heavy, new growth covered with a thick deciduous felt of stellate hairs; leaves thick and heavy, obtuse, 3-lobed; blades 2.5–4.5 cm. long, 2–5 cm. broad, conspicuously 3-veined, dark green above and almost smooth, densely stellate-tomentose below, becoming tawny when old; petioles one-half to one-fourth as long as the blades, densely stellate-pubescent; calyx yellow, large, about 6 cm. in diameter; capsule conical, acuminate, 2.5–3.5 cm. long, 1.5 cm. in diameter at the base.

Coast Ranges from Tehama County to Monterey County, California. Flowering period, March to May. Representative material. Tehama County: Red Bluff, 1917, *Wickes* (CAS). Alameda County: Redwood Peak, 1921, *Kelley* (CAS). San Mateo County: Butano Creek, 1897, *Dudley* (DS). Santa Clara County: on the Soquel Creek, Loma Prieta, *Elmer 5015* (CAS, DS, NY, POM, UC). Santa Cruz County: Big Basin Park, 1918, *Reed* (CAS, type). Monterey County: Salinas, 1917 *Hadden* (CAS).

This is distinguished from other Californian species by the thick, heavy, three-veined leaves, the dense stellate tomentum on the fruits, stems, petioles, and lower surfaces of leaves, by the almost smooth upper surfaces of the leaves and by the large flowers. It may previously have been confused with *F. mexicana* because of the similarity between the two in heavy pubescence, thick leaves and large flowers. However, the hairy basal pits of the calyx lobes, predominantly three- rather than five-veined leaves and clear yellow calyx readily separate *F. crassifolia*.

3. **Fremontia obispoensis** Eastwood, Leaflets West. Bot. 1: 140. 1934.

Shrub, with open branching; flowering twigs somewhat slender, 2–3 mm. thick, young twigs densely stellate-tomentose; leaves small, coriaceous, ovate, obtuse at apex, often with a point, truncate at base; blade prevailingly entire or slightly sinuate, 1.5–2.5 cm. long, 1–2 cm. broad, dull green above, almost smooth, with densely matted white to tawny stellate tomentum below; petiole about one-half the length of the blade; calyx yellow, large, 5–6 cm. in diameter; capsule ovoid acuminate, 2.5–3 cm. long, 1 cm. in diameter at the base.

San Luis Obispo County and south into Santa Barbara County, California. Flowering period, May. Representative material. San Luis Obispo County: Pettitts Canyon, *Eastwood 15159* (CAS, type; NY), 1935, *Sinsheimer* (CAS, DS, NY, RSA); 1 mile south Avenales Ranger Station, *Lee 626* (UC). Santa Barbara County: 4 miles southwest Big Pine Mountain, *Peterson 216* (UC).

This species is a local one, but it seems to be sufficiently distinct to merit specific rank. It resembles varieties *integra* and *diegensis* of *F. californica* in its prevailingly entire leaves but its consistently slender twigs and long acuminate capsules readily distinguish it.

4. FREMONTIA CALIFORNICA Torrey, Smithson. Contrib. 6 (Pl. Fremont.): 5, t. 2. 1854.

Shrub, often large and tree-like, 2–4.5 (7) meters high, spreading to 4 or 5 (9) meters across; bark brownish gray, leaves and flowers produced on short lateral branches; leaves round-ovate to elliptic-ovate, 1–4 (5) cm. long, entire to usually 3-lobed, green and sparsely stellate-pubescent above, white to tawny pubescent or tomentose below; calyx clear yellow, 3.5–6 cm. in diameter, the large glands at the base of the calyx lobes usually densely hairy; capsules ovate-acuminate, 2.5–4 cm. long; seeds brown, dull.

*Fremontia californica* is exceedingly variable in size and shape of leaf blades with much intergradation of forms. There is also considerable variation in the number of hairs on the basal pits of the calyx lobes. Typically, the glandular pits are quite densely covered with long hairs. However, there is a gradation from densely hairy to almost glabrous with only scattered hairs around the edges of the pits or at the base of the staminal tube. Flowers of this type might be mistaken for those of *F. mexicana* upon a merely superficial examination of this single character. This subglabrous condition so intergrades with the typically hairy condition both morphologically and geographically that it does not seem feasible to make any attempt at varietal segregation based upon this character.

### KEY TO VARIETIES OF FREMONTIA CALIFORNICA

Leaves variously lobed.
  Leaves dull green or dark green above; pubescence decidedly tawny below and often matted ............ 4a. var. *typica*
  Leaves bright green above; pubescence whitish below, not tawny. Tehama County ......................... 4b. var. *viridis*
Leaves entire, dull green or dark green above; pubescence of lower surfaces becoming tawny.
  Petioles short, one-half to one-third the length of the blade. Tulare and Kern counties ....................... 4c. var. *integra*
  Petioles longer, more than one-half the length of the blade. San Diego County ............................... 4d. var. *diegensis*

4a. FREMONTIA CALIFORNICA Torrey var. **typica** nom. nov. *F. californica* Torr., Smithson. Contrib. 6 (Pl. Fremont.): 5, t. 2. 1854. *Cheiranthodendron californicum* (Torr.) Baill., Hist. Pl. 4: 70. 1873. *Fremontodendron californicum* (Torr.) Coville, Contrib. U. S. Nat. Herb. 4: 74. 1893. *Cheirostemon californicus* Index Kewensis Supp. 8: 49. 1933, in error.

Leaves variously lobed, dull green or dark green above, pubescence decidedly tawny below and often matted.

Dry foothills of the Sierra Nevada, south to the mountain slopes of southern California. In both the Coast Ranges and the northern Sierra Nevada foothills the stations for *F. californica* are rare or localized. Apparently the greatest size and development are reached in the foothills of Kern County and of the San Gabriel and San Bernardino mountains where the species is a characteristic and important constituent of the chaparral belt; the typical form becomes rarer southward but does occur in Riverside and San Diego counties.

Representative material. CALIFORNIA. "Sources of the Sacramento," *Fremont's Expedition,* 1846 (NY, type). Shasta County: North Bear Creek, *Johannsen 98* (UC). Tehama County: west Paynes Creek, *Heller 13855* (DS, NY). Nevada County: Grass Valley, 1930, *Coombs* (CAS). Mariposa County: western base Chowchilla Mountains, *Bacigalupi 1468* (DS, POM, UC). Merced County: Merced, *Lemmon 76* (UC). Fresno County: Patterson Mountain, 1914, *Wieslander* (UC). Tulare County: South Fork Kaweah River, *Culbertson 4250* (CAS, NY, POM); Eshom Valley, 1910, *Clemens* (POM, UC). Kern County: 1 mile west Onyx, *Abrams 11940* (DS, POM, UC); Keane, 1903, *Jones* (POM, UC); canyon 5 miles west Tehachapi, *Wolf 1680* (DS, LA, RSA, UC); Fort Tejon, *Vesey 16* (DS, NY), *Abrams & McGregor 272* (DS, NY); San Emigdio Canyon, 1931, *Wolf* (CAS, DS, RSA, UC); Frazier Mountain region, Cuddy Canyon, *Wolf 6933* (CAS, DS, LA, NY, POM, RSA, UC). Santa Barbara County: 2.6 miles northwest Josephine School, *Nordstrom 1330* (UC). Ventura County: Mt. Pinos, 1931, *Epling & Dunn* (LA), 1939, *Dudley* (CAS). Los Angeles County: Acton, *Elmer 3686* (DS, NY, POM); Aliso Canyon—Buckhorn Flats road, *Wolf 7861* (CAS, DS, LA, NY, POM, RSA, UC); Sulphur Springs, *Duran 3510a* (CAS, DS, LA, NY, POM, RSA, UC). San Bernardino County: Horsethief Canyon, *Clokey & Anderson 6749* (NY, RSA, UC); Sawpit Canyon, *Clokey & Anderson 7015* (NY, RSA, UC); Van Dusen Canyon, *Ownbey 1673* (DS, NY, POM); Lytle Creek Canyon, *Abrams 2696* (CAS, DS, NY), *Hall 1222* (DS, NY, UC); south side Cajon Pass, *Howell 2540* (CAS, RSA); Cushenberry Grade, 1926, *Jones* (CAS, POM); foothills, north side San Bernardino Mountains, *Parish 140* (DS, NY, UC); Riverside County: Snow Canyon, 1925, *Jaeger* (NY, POM). San Diego County: Laguna Mountains, *Eastwood 9246* (CAS); Cottonwood, 1893, *Alderson* (UC). ARIZONA. Gila County: Rock Creek, fork Pinto Creek, 1926, *Copple & Cooperider* (U. S. Field Station, Sacaton, Arizona); Mazatzal Mountains, 1935, *Collom* (NY, UC).

According to Dr. Carl B. Wolf (Rancho Santa Ana Botanic Garden Occasional Papers 1: 67. 1938), a shrub in the Frazier Mountain region is probably the largest specimen known in California. Its measurements were as follows: height 23 feet, spread 30 feet, four main trunks had diameters of 16, 16, 12 and 8 inches respectively and the entire tree was covered with thousands of flowers.

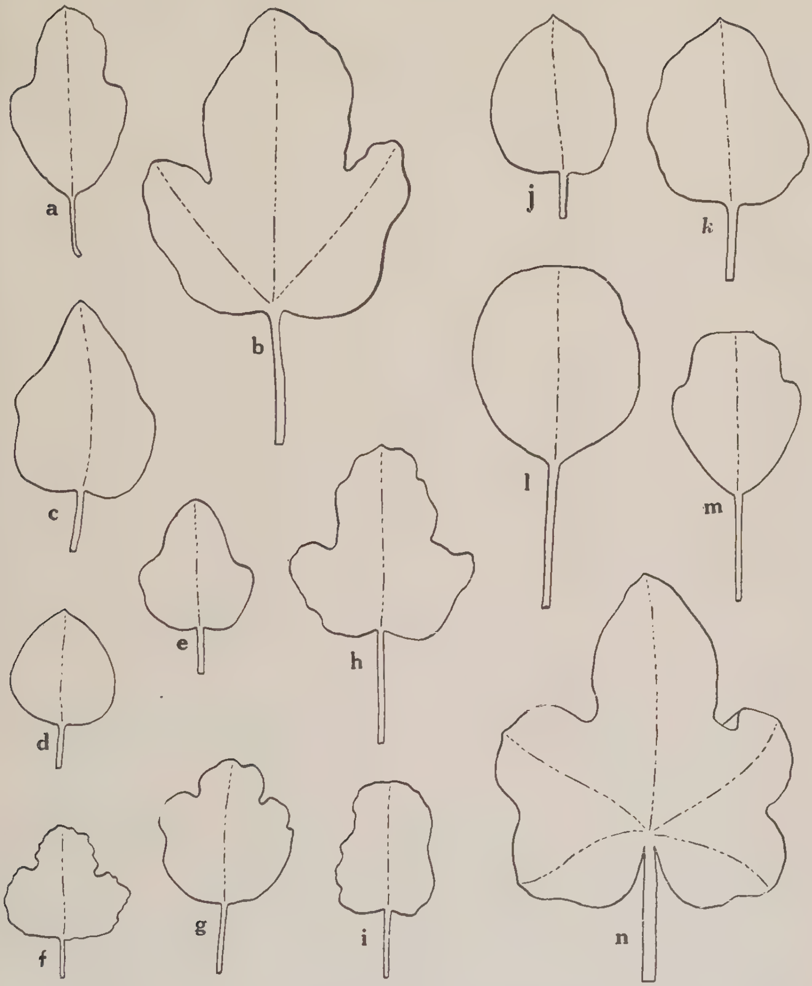

Fig. 1. *Fremontia.* Leaf measurements include both blade and petiole. *a, F. napensis, Hobson* in 1926, type (CAS), length 3.4 cm. *b, F. crassifolia, Reed* in 1918, type (CAS), length 5.8 cm. *c–e, F. obispoensis, Eastwood 15159,* type (CAS), lengths 3.4 cm., 2.4 cm., 2.2 cm. *f, F. californica* var. *typica, Fremont's Expedition,* 1846, type (NY), length 2.1 cm. *g, F. californica* var. *typica, Wolf 6993,* (POM), length 2.9 cm. *h–i, F. californica* var. *viridis, Eastwood & Howell* in 1934, type (CAS), lengths 4.0 cm., 2.7 cm. *j–k, F. californica* var. *integra, Holman* in 1933, type (POM), lengths 2.8 cm., 3.6 cm. *l–m, F. californica* var. *diegensis, Munz 9716,* type (POM), lengths 4.6 cm., 3.7 cm. *n, F. mexicana,* from garden plant, seeds from Ensenada (POM), length 5.5 cm.

The occurrence of *Fremontia* in Arizona is somewhat unexpected; I have neither seen nor heard of other reports of its existence there. The specimens cited are all from the vicinity of

Roosevelt Dam. There seems to be no characteristic by which these specimens can be separated from *F. californica* var. *typica.* The leaves on one specimen are definitely lobed but no other character exists that might link it to either *F. crassifolia* or *F. mexicana.*

4b. Fremontia californica Torrey var. **viridis** var. nov.

Folia matura viridia, varie 3-lobata; subtus sparse pubescentia, albescentia, non fulva.

Mature leaves bright clear green above, variously 3-lobed; pubescence below rather sparse, not matted, whitish, not at all tawny.

Type. Between Paynes Creek and Red Bluff, Tehama County, California, April 21, 1934, *Eastwood* and *Howell* (CAS 216397).

With var. *typica,* northern Sierra Nevada foothills of Tehama County and south into Butte County, California. Flowering period, April to May. Other collections. Tehama County: Red Bluff, 1917, *Wickes* (CAS); ridge west Paynes Creek, *Heller 15350* (NY, POM, UC); 8 miles above Paynes Creek, *Wolf 9069* (RSA); 2.3 miles below Paynes Creek, *Wolf 8704* (RSA); 10 miles west Mineral, 1939, *Cantelow* (NY). Butte County: Durham, 1935, *Brown* (CAS).

The combination of clear green leaves and whitish pubescence gives this variety a much brighter green appearance than var. *typica.*

4c. Fremontia californica Torrey var. **integra** var. nov.

Folia subintegra; laminis 1.5–3 (4) cm. longis, supra viridibus, subtus fulvescentibus; laminis bis ad ter longioribus quam petiolis.

Mature leaves subentire, blade 1.5–3 (4) cm. long, dull green above, becoming tawny pubescent below; petioles relatively short, one-half to one-third the length of the blade.

Type. Road to Mineral King, about 10 miles from Generals Highway, Tulare County, California, May 22, 1933, *R. M. Holman* (POM 209740, type; isotypes at CAS, DS, LA, NY, RSA, UC).

With var. *typica,* slopes of foothills and mountains of Tulare and Kern counties, California, rarely south. Flowering period, April to June. Other collections. Tulare County: 25 miles from Lemon Cove, 1925, *Stephens* (POM). Kern County: Greenhorn Mountains, *Weston 106* (CAS); Kern River Canyon, *Gander 7566* (SD); 4 to 5 miles south Tehachapi, *Wolf 2188* (CAS, DS, POM, RSA, UC).

This variety differs from varieties *typica* and *viridis* by its subentire leaves and may be separated from var. *diegensis* by the relatively shorter petioles.

4d. Fremontia californica Torrey var. **diegensis** var. nov.

Folia integra, supra viridia, subtus fulvescentia; laminis 2–2.5 cm. longis; laminis minus bis longioribus quam petiolis.

Mature leaves entire, dull green or dark green above, becoming tawny pubescent below; blades 2–2.5 cm. long; petioles long, more than half the length of the blade.

Type. Bottom of Vallecito Canyon, Laguna Mountains, San Diego County, California, May 17, 1925, *Philip A. Munz 9716* (POM 97297).

With var. *typica,* foothills and mountains of San Diego County, California. Flowering period, May to June. Other collections. San Diego County: 40 miles east San Diego, *Spencer 469* (NY, POM); Viejas Grade, *Wolf 7989* (RSA), 1941, *Harvey* (POM), 1935, *Gander* (DS, SD); Shaw Canyon, Laguna Mountain, *Gander 2469* (DS, SD).

Subentire leaves separate this variety from varieties *typica* and *viridis* and relatively long petioles distinguish it from the similar but geographically separate var. *integra.*

5. Fremontia mexicana (Davidson) Macbride, Contrib. Gray Herb. n.s. 53: 14. 1918. *Fremontodendron mexicanum* Davidson, Bull. So. Calif. Acad. Sci. 16: 50. 1917. *Fremontia californica* Torr. var. *mexicana* (Davidson) Jepson, Man. Fl. Pl. Calif. 637. 1925.

Large, often tree-like shrub, 2–6 meters high, spreading; branches clothed with densely matted, almost black stellate tomentum; leaves thick, heavy, 5-lobed; blade 2.5–3.5 cm. long and as broad, cordate at the base, conspicuously 5-veined, dark green above with scattered dark stellate hairs, densely matted tomentum below becoming almost black on older leaves; petioles stout, densely tomentose; calyx large, 6–7 cm. in diameter, orange becoming reddish at the base and along the midvein, with rounded pits at base of calyx lobes devoid of hairs; capsule ovoid, acuminate, 3–4 cm. long, 2 cm. in diameter at the base; seeds black, shiny.

Type locality. Dr. Davidson in his original description states that the species was first known from specimens grown by Miss Kate Sessions of San Diego from seed "collected near Ensenada." In a letter to Mr. Frank F. Gander of the San Diego Natural History Museum, Miss Sessions says that she obtained the seed from a plant found at the corner of Fourth and Fir Streets, San Diego, which she always supposed to have been brought in by Charles R. Orcutt. In conversation with Mr. Gander, she also said that she had never collected *Fremontia* seed near Ensenada nor elsewhere in Baja California. Dr. Davidson also states that the specimens upon which the description was based were gathered by Miss Sessions "15 miles from San Diego" while Miss Sessions in conversation with Mr. Gander said she thought that the material which she sent to him all came from her own yard. The species does occur in the wild within twenty miles of San Diego on the west side of Otay Mountain.

Southern San Diego County, south into Baja California. Flowering period, March to July. Representative material. CALIFORNIA. San Diego County: Jamul, 1878, *Sanford* (SD); Monument, 1875, *Dunn* (SD); Otay Mountain, *Wolf 7982* (RSA), *Gander 1550* (POM, RSA, SD). "From a garden grown plant, seeds originally from Lower California (Ensenada)," (POM, isotype). BAJA CALIFORNIA: Johnson's Ranch (San Antonio), 1925, *Jones* (CAS, DS, NY, POM); San Antonio Canyon, 1925, *Ballou* (POM, UC); Cypress Canyon, San Antonio Mesa, 1936, *Epling & Stewart* (LA, DS, NY).

*Fremontia mexicana* is readily separated from other members of the genus: the rounded basal pits of the calyx lobes are devoid of hairs, the calyx is large and orange, the leaves are thick and heavy and conspicuously five-veined. Collections of *F. mexicana* have been reported from as far north as Sonoma County, but all such collections north of San Diego County that I have seen proved to be either *F. californica* var. *typica* or *F. crassifolia.* The manner of flowering of *F. mexicana* is quite different from that of the other species. Instead of a simultaneous mass of flowers, it produces fewer at one time but extends the blooms over a longer flowering period. According to Davidson (Bull. So. Calif. Acad. Sci. 16: 50. 1917), several other characters help to distinguish *F. mexicana* from the other species of *Fremontia.* The seeds are smaller and darker (this difference first caused Mr. Payne to show Dr. Davidson the seed which Miss Sessions had sent to him) and the manner of growth is at first characteristically different. "The seedlings shoot up straight as a miniature tree, while those of *F. californica* branch from near the base at an early stage."

Pomona College,
Claremont, California,
August, 1942.

## THE GENUS STYRAX IN CENTRAL AND WESTERN TEXAS

V. L. CORY

Only one species of *Styrax* has been reported as occurring in central Texas whereas none was known from western Texas. The known species is *Styrax platanifolia* Engelm. which ranges from Kimble County east to Llano, Blanco and Travis counties. In this general area in 1940 I found two other well marked members of this genus which are to be differentiated, one as a variety of *S. platanifolia* and the other as a well marked species, types of which are at the Herbarium of the Arnold Arboretum. In making this study I was privileged also to examine material of another undescribed member of the genus that was taken in the Davis Mountains of southwestern Texas in 1914, and apparently to date is the only collection ever taken of this plant. A contrast of certain characters of the three species concerned is exhibited herewith.

| *S. platanifolia* | *S. texana* | *S. Youngae* |
|---|---|---|
| Upper leaf surface dull green, glabrous to bearing scattered stellate trichomes, reticulate-veiny. | Upper leaf surface bright green, glabrous, not reticulate-veiny. | Upper leaf surface dull green, densely and coarsely stellate-pubescent, not reticulate-veiny. |
| Lower and upper leaf surfaces similar. | Lower leaf surface markedly dissimilar to upper leaf surface, bright silvery with a very fine and dense indumentum only. | Lower leaf surface dissimilar to upper leaf surface, but not markedly so; grayish tomentose with a fine and dense indumentum beset with coarse stellate hairs. |
| Pedicel glabrous to nearly so. | Pedicel puberulent. | Pedicel densely, coarsely stellate-pubescent. |
| Calyx dark-brown, glabrous to finely puberulent; apex glandular and prominently toothed. | Calyx pale, densely puberulent; apex glandular and prominently toothed. | Calyx dark-brown, densely stellate-pubescent; apex non-glandular, the teeth inconspicuous. |
| Style pubescent halfway to apex. | Style pubescent only at base. | Style pubescent nearly to apex. |

In the description of *S. platanifolia* it is stated that the foliage is glabrous or nearly so and that even the pedicels and calyx are glabrous or nearly so. This characterization is accurate for the plant as it occurs in the northern and eastern portions of its range, but elsewhere the plant is entirely that form described herewith as variety *stellata*.

STYRAX PLATANIFOLIA Engelm. var. **stellata** var. nov. A specie differt foliis indutis trichomatibus stellatis grossis latissimae dispersis, calyce indumento denso minuto obtecto.

*Styrax platanifolia* var. *stellata* differs from the species in that the leaves bear scattered coarse stellate trichomes and in that the calyx is covered with a dense fine indumentum.

Type. Sabinal Canyon, about six and one-half miles north of Vanderpool, Bandera County, Texas, June 16, 1940, *Cory 34765*.

Representative collections. Kendall County: Spanish Pass, July 5, 1911, *Clemens & Clemens; E. J. Palmer 9843, 11474*. Bandera County: Upper Seco Creek, *E. J. Palmer 10237*. Blanco County: Twin Sisters, June 2, 1940, *Mrs. Kush*.

*Styrax platanifolia* and its variety *stellata* occur in the Edwards Plateau area of Texas, the species centering about southern Llano County and the variety some 50 miles south and southwest in Bandera and Kendall counties. They are not known to occur together or the one to occur in the distributional area of the other.

The upper or western edge of the Coastal Plain lies at an elevation of about 600 feet and the Escarpment of the Edwards Plateau to the west rises to an average elevation of 2200 feet. At its western side (Marathon Basin) the edge of the Edwards Plateau has an elevation of 4000 feet. The various drainage courses make the descent from the Plateau to the Coastal Plains through canyons. The vegetation of these canyons is similar to that of the Escarpment and is unlike that of the Coastal Plains or of the summit of the Plateau. The genus *Styrax* in this area occurs only on the Escarpment and in the canyons. In July, 1940, a new species of *Styrax* was found further west in one of these canyons, and it is described herewith.

**Styrax texana** sp. nov. Frutex vel arbuscula patens, 1.5–3 m. altus, calciphilus in praeruptis; foliis deciduis, aeque longis ac latis, ad 6.5 mm. latis, integris, apice basique abrupte acutatis, basi caeterum truncata vel rotundata, tenuibus, supra laete viridibus levibus, subtus indumenti causa minute denseque serecei argentatis; floribus post medium Aprilem in anthesi, pedicellatis pedunculatisque, saepius 3–5 glomeratis, pedunculis pedicellis aequantibus vel interdum longioribus, promore recurvatis, subglabratis vel puberulis; calyce pallido, corolla concolori, dense puberulo, campanulato, ca. 5 mm. longo, 4 mm. lato, truncato, margine glandulari 6–7-dentato, dentibus ca. 1 mm. longis, anguste triangularibus, glandulosis; petalis 5, puberulis, anguste ellipticis, obtusis, ad 2 cm. longis; fructu sicco, globoso, ca. 8 mm. diametro, pedicellato, valvis 3, serius dehiscentibus, 1- vel 2-loculato, semine in loculo quove unico; pedicello sub fructu saepissime recurvato, bene subulato; stylo basi crasso, 15–18 mm. longo, basi ad 2 mm. vel ultra canescente, caeterum glabro, gracili, apice curvo vel recurvato.

Spreading, graceful shrub, 1.5–3 m. high, usually growing in inaccessible places on steep limestone cliffs; leaves about as broad as long, up to 6.5 cm. broad, petioled, entire, abruptly acute at apex and base, the base otherwise truncate or rounded, thin, bright green and smooth above, silvery with a very fine and dense silky indumentum below; flowers appearing the last half of April, pedicellate and pedunculate, usually in clusters of 3 to 5, the pedicel puberulent, as much as 1 cm. long, the peduncle about as long as the pedicel or sometimes longer, frequently recurved, subglabrate to puberulent; calyx pale, similar in color to the corolla, densely puberulent, campanulate, about 5 mm. long, 4 mm. broad, truncate, the apex glandular, 6- to 7-toothed, the teeth about 1 mm. long, narrowly triangular and glandular-tipped; petals 5, puberulent, narrowly elliptic, obtuse, up to 2 cm. long; fruit dry, globose, about 8 mm. in diameter, pedicellate, 3-valved, tardily dehiscent, 1- or 2-celled, each cell 1-seeded; pedicel in fruit frequently recurved, tapering throughout; style stout at base, 15–18 mm. long, canescent for 2 mm. or more at the base, glabrous, slender, and curving or recurved above.

The foliage of *S. platanifolia* is of relatively larger leaves of a coarser texture and dull green throughout, undulate or angulate-toothed or even sinuate-lobed, and prominently reticulate-veiny, whereas the foliage of *S. texana* is of rather smaller entire or subentire leaves of a finer texture and with the two leaf-surfaces being markedly dissimilar in that the upper surface is smooth and very bright green and the lower surface is bright silvery with a very dense fine and silky covering, and neither surface is reticulate-veiny. Moreover in *S. texana* the calyx is densely puberulent while in *S. platanifolia* the calyx is glabrous or nearly so. The former species occurs to the west of the latter and at an elevation of several hundred feet greater.

Type. Altitude 1975 feet, west side of Polecat Creek, about one-half mile above its junction with Pulliam Creek (which joins the Nueces River at about eleven airline miles southeast), Edwards County, Texas, July 4, 1941, *Cory 34940*.

This type locality is nine and one-half miles south and five miles east of Rocksprings and, on an airline, is about forty-five miles directly west of the Sabinal Canyon locality of *S. platanifolia* var. *stellata*. The only other known locality is in the same county and is about seven miles southwest by airline. Here, on the north side of Cedar Creek Canyon, a tributary of Pulliam Creek, one shrub is growing on a very narrow shelf on a steep limestone cliff.

The discovery plant of *Styrax texana* was found along Pulliam and Polecat creeks on July 4, 1940. The single shrub seen was so unlike the variety of *S. platanifolia* which I had seen in Sabinal Canyon that I became strongly interested in it. In the following year in the same region in Polecat Canyon, additional shrubs of this plant were found higher up on the cliffs. Later, a single shrub of the plant was found along Cedar Creek. In 1942 special efforts were made to see this plant in bloom. On April 5 the sixty-five mile trip to the Cedar Creek site was made; it was found that the foliage of the plant was immature and the inflorescence was only in bud. On April 18 a visit was made to the discovery plant in Polecat Canyon where our efforts were fully rewarded. In our opinion *S. texana* should prove to be a highly desirable ornamental plant for growth in the limestone areas of Texas.

**Styrax Youngae** sp. nov. Frutex 2.5–3 m. altus; foliis minoribus orbicularibus, majoribus ellipticis, ad 5 cm. longis, 3.5 cm. latis, subintegris, apice basique plus minusve rotundatis vel apice paulo acutatis, tenuibus, supra viridibus at pilis grossis stellatis dense indutis, subtus tomentosis neque argenteis, indumento minuto denso pilis, stellatis grossis consperso, nervis colore stramineo prominentibus, brevipetiolatis; floribus medio Aprili mense in anthesi, 3–7 aggregatis racemosis, pedunculis valido, 4–20 mm.

longo, grosse stellato-pubescente, pedicello valido, 4–8 mm. longo, dense grosseque stellato-pubescente; calyce campanulato, ca. 4 mm. longo latoque, nigro-brunneo, dense stellato-pubescente, apice truncato, eglanduloso, dentibus inconspicuis; petalis 5, 15–17 mm. longis, anguste ellipticis obtusis, dense stellato-puberulis; fructu ignoto; stylo valido, 16–17 mm. longo, fere ad apicem stellato-pubescente.

Plant a shrub, 2.5–3 m. high; smaller leaves orbicular, larger leaves elliptical, up to 5 cm. long and 3.5 cm. broad, subentire, more or less rounded at the apices and bases or somewhat acute at the apices, thin, green above but densely pubescent with coarse stellate hairs, tomentose below, but not silvery, with a very fine and dense indumentum which is beset with coarse stellate hairs, veins prominent and straw-colored, short-petioled; flowers appearing the middle of April, in racemose clusters of 3–7, peduncles stout, 4–20 mm. long, coarsely stellate-pubescent, pedicels stout, 4–8 mm. long, densely and coarsely stellate pubescent; calyx campanulate, about 4 mm. long and 4 mm. broad, dark-brown, densely stellate-pubescent, apex truncate, non-glandular, the teeth inconspicuous; petals 5, 15–17 mm. long, narrowly elliptic, obtuse, densely stellate-puberulent; fruit not seen; style stout, 16–17 mm. long, stellate-pubescent to near the apex.

Type. Canyon, Davis Mountains, Texas, May 12, 1914, *Dr. Mary S. Young* (Herbarium of the University of Texas).

This is the only collection of *Styrax* from the mountains of southwestern Texas. The exact type locality is unknown, but likely it was some minor canyon for the larger ones are named and were well known even more than thirty years ago. The description is based upon the type specimen and the species is named in honor of its discoverer.

Both *S. platanifolia* and *S. texana* grow on highly calcareous soil, whereas *S. Youngae* grows in soil of igneous origin and in which free limestone is absent. *S. texana* grows at elevations just below 2,000 feet and *S. platanifolia* grows at elevations of a few hundred feet lower, whereas *S. Youngae* grows at elevations in excess of 4,000 feet. In between the elevations of 2,000 and 4,000 feet in Texas there are no plants whatsoever of *Styrax*. It seems probable that *S. Youngae* is a species of northern Mexico, for at that point in far western Texas there are mountains on both sides of the Rio Grande. Inasmuch as the plant has not been found in the twenty-nine years intervening since its original collection this species must be rare and at its northern limit in the Davis Mountains of southwestern Texas. On the other hand neither *S. platanifolia* nor *S. texana* is likely to be found in northern Mexico, for both species are so far unknown from that portion of the Edwards Plateau which extends along the Rio Grande.

It is known that *Styrax* has disappeared from localities where once it was not uncommon, and it seems to be true that at the present time it grows mostly in places inaccessible to the Angora goat, or in places where this animal is not grazed. The circumstantial evidence is that the foliage of *Styrax* is palatable as browse to these hardy animals that produce our mohair.

It has not been my pleasure or privilege to meet the late Dr. Mary S. Young, but I do wish to accord my recognition of the accomplishments of this pioneer botanist in her explorations of the flora of the mountains of southwestern Texas by naming the *Styrax* of her collection in her honor. I trust that this may offset my part in pointing out that *Talinum Youngae* C. H. Muller, also a plant of the Davis Mountains, is synonymous with *T. pulchellum* Woot. & Standl.

I wish to acknowledge my good fortune in having had valuable assistance given me by Dr. I. M. Johnston in his study of my material, in criticism of my provisional manuscript, and in the loan of the *Styrax* material from the Herbarium of the Arnold Arboretum, by Dr. B. C. Tharp for criticism of the original manuscript and for the loan of the *Styrax* material from the Herbarium of the University of Texas, and by Dr. P. A. Munz for study of my material, for the loan of *Styrax* material from the Herbarium of Pomona College, and for the loan of the volume of "Das Pflanzenreich" which contains the treatment of Styracaceae. I am deeply grateful to these gentlemen. Furthermore, I wish to express grateful appreciation to Dr. Leon Croizat for valuable assistance given me in the preparation of the Latin descriptions in this manuscript.

Texas Agricultural Experiment Station,
Sonora, Texas,
May 9, 1943.

# THE STORY OF PARTHENIUM ALPINUM

George J. Goodman

In the spring of 1834, Thomas Nuttall and John K. Townsend left St. Louis with the Wyeth Expedition, bound for Fort Vancouver, Oregon. One of the plants collected on the expedition was *Parthenium alpinum* (Nutt.) T. & G., first described by Nuttall (9) as *Bolophyta alpina.* This curious little plant, which, except for the heads, resembles a caespitose *Actinea,* has not been recollected along Nuttall's route, and the type locality has not been determined definitely. The data given by Nuttall are indefinite and confusing, and subsequent literature is of little help.

A comparison of Nuttall's description with Townsend's journal will reveal the difficulty. Here are Nuttall's words (p. 348): "Hab. In the Rocky Mountain range; latitude about 42° and seven thousand feet above the level of the sea. On shelving rocks, on the summit of a lofty hill, near the place called the

'Three Butes' by the Canadians, towards the sources of the Platte. Flowering in June."

The "sources of the Platte," that portion of the North Platte where Nuttall was, are certainly in Wyoming. Further, during all of June of 1834, the Wyeth Expedition was in what is now Wyoming. "On the 1st of June, we arrived at Laramie's fork of the Platte, and crossed it without much difficulty" wrote Townsend (12) in his narrative (p. 181). On June 30th the Expedition was still at the rendezvous on the Siskadee (Green River) in western Wyoming. On July 4th "we left Ham's fork this morning" (p. 197). Ham's fork is entirely within western Wyoming. Nuttall states, it will be noted, that the plant was flowering in June. Inasmuch as he described the anthers, style, and stigma, it would seem that he must have collected it in flower. A subsequent collection from northern Utah, made by Dr. Edward H. Graham, was collected *in flower,* in late May. The phrase "flowering in June" cannot be taken as proof of the collecting time, however. It is true that Nuttall's three new species of *Townsendia* (pp. 305–306), his two new species of *Actinella* (p. 379), and his new *Sphaeromeria* (p. 402) are all stated to have been collected near the sources of the Platte and "flowering in June." These are now known to be Wyoming plants, and hence were collected in June. On the other hand, he states that his *Stenotus acaulis* (p. 334) was collected "near the borders of Little Godin River, in the Rocky Mountains. Flowering in June." Nuttall was at "Little Godin River" about August 9.

If the plant really was collected in June, and near the "sources of the Platte," it was probably found 50 to 100 miles up or down the river from Casper, Natrona County. Perhaps Nuttall's "Three Butes" was in Wyoming but the name was not perpetuated in the locality. It is a land of buttes, Twin Buttes, Bear Mountain, Dead Man Butte, Square Top Butte, Red Buttes, and Teapot Dome all being in Natrona County, and appearing on a popular road map. It is noteworthy that two other species of Nuttall, *Actinella Torreyana* and *A. lanata,* have collecting data nearly identical to that of the *Parthenium,* namely (p. 379) "on the lofty hills or mountains, called the 'Three Butes' of the upper Platte, on shelving rocks. Flowering in June." Both of these species occur in Wyoming, and neither is reported in the manuals of the region from as far west as Idaho.

There is evidence, however, that the type locality is 325 miles to the westward, in Idaho, far from the headwaters of the Platte and the Atlantic drainage. "Our encampment this evening," wrote Townsend, in his journal under the date of July 11, 1834, "is on one of the head branches of the Blackfoot River, from which we can see the three remarkable conic summits known by the name of the 'Three Butes' or 'Tetons.' Near these flows the Portneuf, or south branch of the Snake or Lewis River." That the Three Buttes are obvious on the scene is assured me by Dr. Walter E. Loomis, who kindly made some observations of the terrain when motoring through the region.

Few modern maps retain the name of "Three Buttes" for the conspicuous cones on the north side of the Snake River near Fort Hall and Pocatello, but that they were commonly called that a century ago is documented by Fremont (3, p. 161 [174]) where they are referred to in the journal and on the main map, and by Stansbury (11, p. 93) when he visited Fort Hall in 1849.

Townsend's "Tetons" does not refer, of course, to the Grand Tetons, which are over 100 miles away.

The only collections known to me since Nuttall's are three from Utah. In 1910 Jones (7) published his variety *ligulatum* from ". . . nearly bare clayey and gravelly knolls on ridges at 6000° alt. forming dense mats . . . Theodore [Duchesne] Utah . . . ." Dr. Edward H. Graham (5) subsequently collected the plant 70 miles southwest of Jones' locality, at 6300 feet, on May 26, 1935, in flower; and Mr. E. P. Killip tells me that there is a specimen in the U. S. National Herbarium with these data: "dry rocky places, 7000 ft., San Rafael Swell, Emery Co., Utah; June 6, 1932, W. P. Cottam 5259."

The distances from the Utah stations to the Wyoming and the Idaho possibilities are, coincidentally, practically identical—about 250 miles.

There is little phytogeographic evidence favoring the Idaho more than the Wyoming locality. The distribution of many species in Idaho and northwestward, south through western Wyoming and northern Utah is indicated in manuals of the region, in many monographs, and has been pointed out by others (4, 6). But numerous species found in eastern Wyoming are found in northern Utah, too. For example, of nine other plants described by Nuttall at the time which had similar data, such as "toward the sources of the Platte," "On the Black Hills, near the sources of the Platte," etc., five have been collected in the Uinta Basin, Utah, by Graham. All nine are recorded for Wyoming in the manuals and in Esther Larsen's revision of the genus *Townsendia* (8) but *none* of them are listed for Idaho.

Further evidence that Idaho contains the locality in question is this: Townsend refers to the "Canadians," some of McKay's men, several times while in the vicinity of Fort Hall.

The latitude of the two possible type localities is too nearly the same to be helpful when compared with forty-two degrees as estimated by Nuttall. The elevation given by Nuttall (7000 ft.) favors, slightly, the Wyoming locality, but the collection need not have been made very far to the northwest of Three Buttes, Idaho, toward the Lost River Mountains, to be at 7000 feet.

The manuals and floras of the region (1, p. 179, 2, p. 540, 10, p. 924) all give Wyoming as the range.

Did Nuttall collect his plant near the headwaters of the Platte, in June, as he says, or near the Three Buttes, called thus by the Canadians—as he also says? Future collecting may decide it.

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# TWO TYPES OF BROAD-LEAF ERODIUM IN CALIFORNIA

Kenneth A. Wagnon and Harold H. Biswell[1]

Shortly following the initiation of the range forage and cattle investigations at the San Joaquin Experimental Range,[2] O'Neals, California, in 1935, two distinct forms or types of broad-leaf *Erodium* were observed on the station lands. According to Jepson's manual (4) both types would be classified as *Erodium Botrys* (Cav.) Bertol. Growth habits of the two types differ considerably and often have a pronounced effect on the length of time green forage is available for livestock and on the total bulk of feed produced; therefore, it is economically important to be able to differentiate between them. They are easily recognized both in the cotyledon stage and after the appearance of floral parts, but are difficult or impossible to separate in the intermediate rosette stage. Several plantings studied in the station greenhouse and in the forage plant nursery all bred true to type, and widely distributed field observations in California have not revealed any evidence of intergradation. Chemical analyses at different comparable growth stages by Gordon and Sampson (3) revealed differences in forage values between the two types, and investigation of collections made by the authors, and as yet unpublished, showed essentially the same differences.

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[2] Maintained by the Department of Agriculture, United States Forest Service, in cooperation with the University of California, Berkeley, California.

Because these plants differ so markedly in growth habit and have such significance in affecting the forage crop, it seemed worthwhile to check their identity by comparison with Old World species of the genus, particularly of the Mediterranean region, where most of them supposedly originated. During these times when much of the world is cut off from us we must rely on such material as is available to us in American herbaria. Specimens of the two entities were sent to several botanists for identification and were returned with determinations based upon the treatment by Knuth in "Das Pflanzenreich" (5), either as *E. Botrys* and one of its varieties or as *E. Botrys* and one of the closely related species. Fortunately, one of the finest collections of Mediterranean plant specimens to be found in North America is located in the private herbarium of Dr. Herman Knoche at San Jose, California. This herbarium is especially rich in the classical sets of the early Mediterranean collectors as well as in the personal collections of Dr. Knoche. A study was made of all of the species of *Erodium* represented and none of the specimens matched one type of the California material under consideration while the other type was definitely established as *E. Botrys,* a species richly represented in the Knoche herbarium. In the synonymy of Knuth's treatment of *E. Botrys* it was noted that Brumhard (1, 2) had published as a *nomen nudum,* and later validated with a description, the name, *E. Botrys* f. *montanum,* based upon a specimen collected by Hansen from Amador County in California. A collection from Chacabuco in Chile was also cited. Comparison of our material with a duplicate of the Hansen specimen indicates that the two are identical and substantiates the observations of Brumhard. It must be taken for granted, in the absence of evidence to the contrary, that because Brumhard, a European monographer of the group, did not cite European material for an entity which he clearly recognized, he apparently did not encounter such material in any of the herbaria where he studied.

Since the precise taxonomic rank of our material is outside the scope of this paper we will use the name given it by Brumhard and here will only direct to the attention of taxonomists our further observations as to differences between these two entities.

A simple key that has proved very useful for mature plants in the field at the San Joaquin Range follows:

Beak (rostrum) 9.5–12.5 cm. long; fovea surrounded by two plicae; sepals with prominent brownish mucro, upper sepal red-margined; flowers large, petals about twice sepal length, stamens about sepal length .................... *Erodium Botrys*

Beak (rostrum) 5.5–8.5 cm. long; fovea surrounded by one plica; sepals short-mucronate; flowers small, petals about one and one-fourth sepal length, stamens about one-half sepal length .................................... *Erodium Botrys* f. *montanum*

The two forms can be readily identified in the seedling stage by their relative size and by the shape of their cotyledons. The seedlings of *E. Botrys* f. *montanum* are smaller and the cotyledons have one small incision in the margin, while those of the species are larger and their cotyledons have several more distinct incisions (fig. 1).

The red margins on the upper sepal of *E. Botrys* and the difference in concentric folds about the fovea of the rostra of the two types are perhaps the characters best used for differentiation, and thus far they have proved infallible. Plants of *E. Botrys* f. *montanum* are not so robust as are those of *E. Botrys* (figs. 2, 3). In the rosette stage the stems of *E. Botrys* f. *montanum* are usually not as reddish or coarse as are those of *E. Botrys,* although it is not always possible to separate the plants accurately on this basis. Simple characters need to be found to separate the plants in the rosette stage under all conditions of habitat. Detailed descriptions of the two entities follow.

**Erodium Botrys** (Cav.) Bertol. Annual, 8–90 cm. high. Cotyledons oblong, incised. Stems one to many from base, decumbent to ascendent, upper surfaces usually reddish; pubescence coarsely hirsute, hairs whitish-translucent, retrocurved, often glandular. Basal leaves often numerous, petioles usually equal in length or longer than maximum of lamina, hirsute, hairs whitish-translucent, often glandular, lamina ovate, 3–4 lobate, often sublobate, lobes incised-dentate. Cauline foliage opposite; petioles of lower portion of stem often equal or greater than maximum of lamina, upper often sessile, finely hirsute, hairs whitish-translucent, often glandular, lamina ovate, 3–5 partite, mostly quadripartite, lower segments often divided, lobes acute, incised, sinuses moderate to wide. All leaves usually setose-pilose on veins and margins, glandular hairs often present on veins beneath. Stipules ovate, somewhat acute, membranous, pallid or dusky, ciliate, usually 4–5 mm. wide and long. Peduncles varying in length with the lower up to 20 cm. and the upper 2–6 cm. long, usually reddish above, glandular-pubescent. Involucre multibracteate; bracts ovate or lanceolate, acute, membranous, pallid or dusky, minutely ciliate, about 2 mm. wide and 3 mm. long. Pedicels 1–4, upper surfaces dark red, glandular-pubescent, 15–25 mm. long, after anthesis usually retrocurved. Calyx inflated following anthesis and more or less refracted after fruit matures. Sepals ovate, midrib produced into a prominent brownish mucro, setose, glandular-pubescent, upper sepal red-margined, 13–15 mm. long and 4–5 mm. wide. Flowers large, lavender, remaining open most of day. Petals spreading, about twice calyx length, obovate and with sparsely pubescent angular base. Stamens five, alternating with five sterile, scale-like filaments, filaments of fertile stamens dilated nearly to apex and toothed, about calyx length. Prominent greenish gland with brownish apex at base of each anther-bearing stamen. Pistil densely silvery-villous. Rostrum 9.5–12.5 cm. long with densely appressed short hairs and minute glandular hairs, inner surface barbate; valves with short spreading stiff hairs, bearing twin glabrous foveae which are surrounded by two plicae. Seed 4–4.5 mm. long and about 1.5 mm. in diameter.

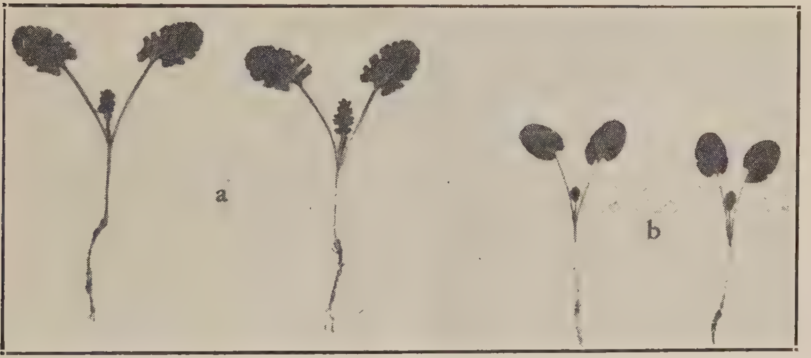

Fig. 1. Young seedling stage: *a, Erodium Botrys; b, Erodium Botrys* f. *montanum.*

The following representative specimens, except where otherwise noted, are in the Knoche herbarium, San Jose, California. Canary Islands: Teneriffe, *Knoche 771.* Algeria: Djebel el Ouach, *Choulette 517; Reboud,* April, 1879. Portugal: Lisbon, *J. Daveau,* 1879. Balearica: Majorque, *Knoche 127.* Corsica: Bonifacio, *Knoche* in 1908; Bastelia, *Reverchon,* May 23, 1878. Sicily: Ficuzza, *Parlatore,* without date; (Sicula) Alcano, *Todaro 630.* Turkey: Cavalla, *Sintenis* and *Bornmüller 190.* California: O'Neals, Madera County, *Wagnon 2, 102* (Herbarium University of California).

Erodium Botrys (Cav.) Bertol f. montanum Brumhard. Annual, 5–55 cm. high. Cotyledons oblong, usually with one small incision. Stems one to many from base, ascendent to erect; hirsute, hairs whitish-translucent, retrocurved, usually glandular. Basal leaves often numerous, petioles usually equal or greater

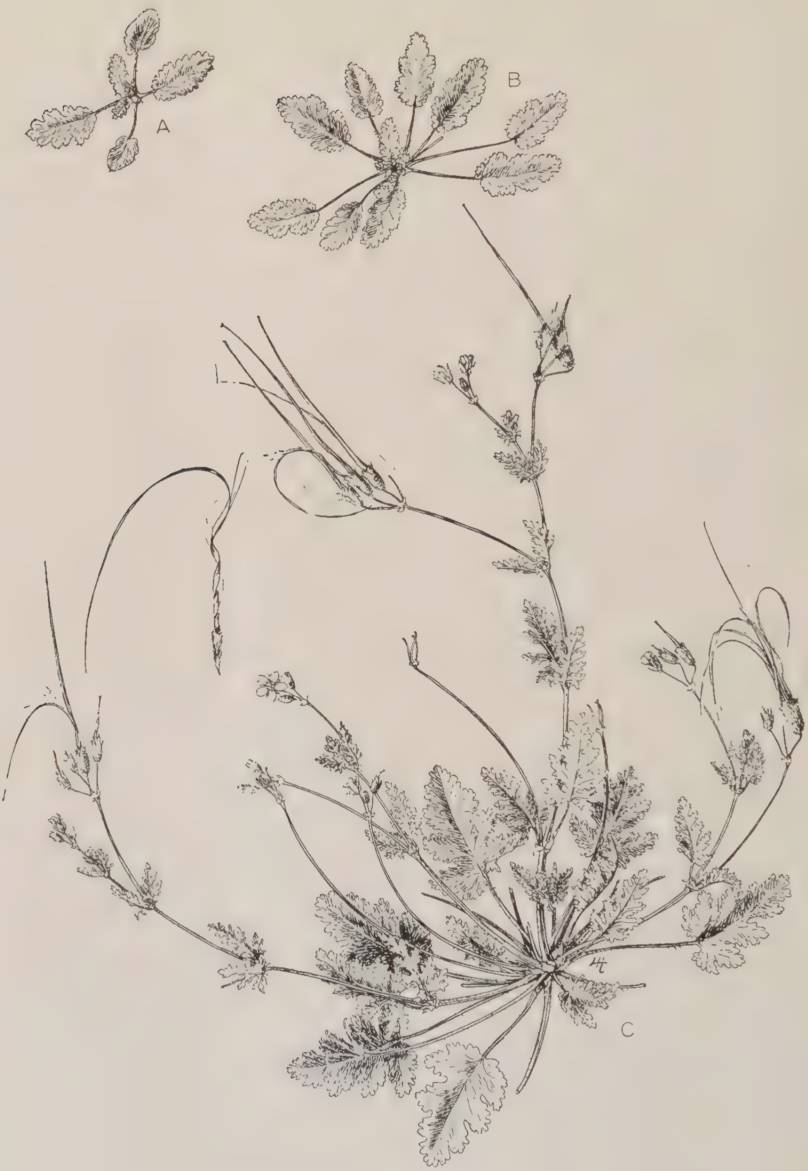

Fig. 2. *Erodium Botrys* f. *montanum* in different stages of growth.

than maximum length of lamina, finely hirsute, often glandular-haired, lamina ovate, 3–4 lobate and often sublobate, lobes incised-dentate. Cauline leaves opposite; petioles of lower portion

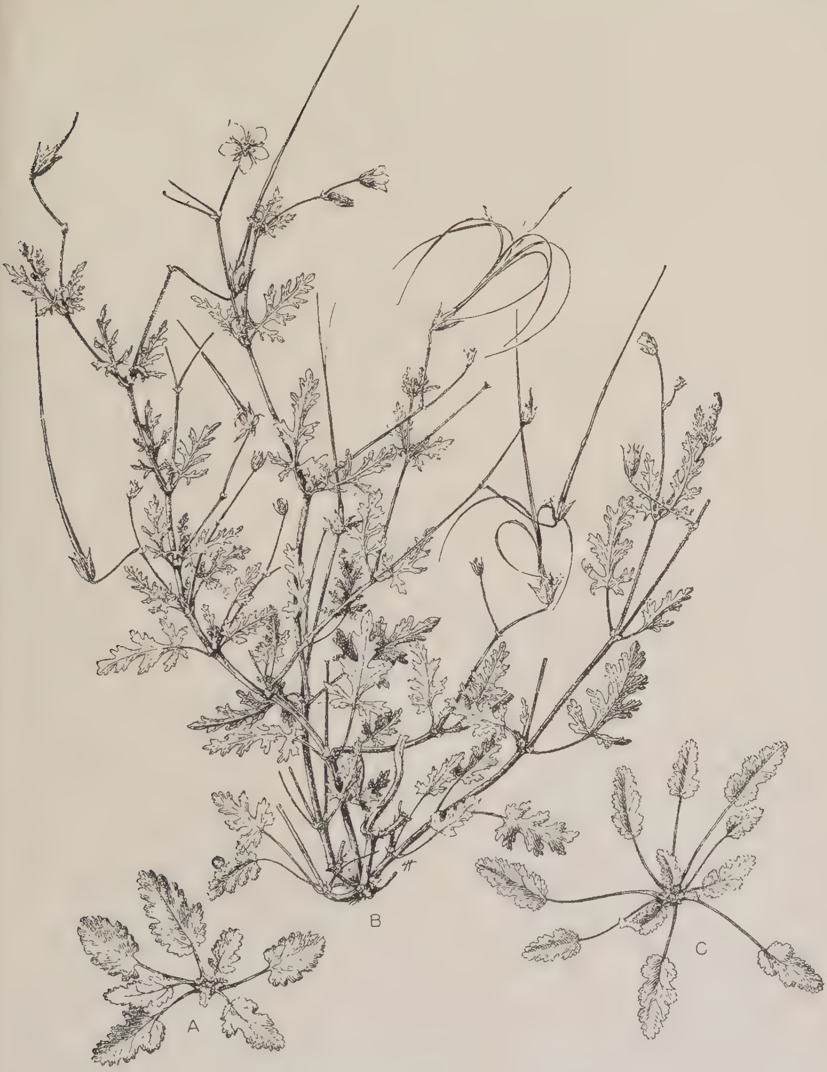

FIG. 3. *Erodium Botrys* in different stages of growth.

of stem often equal in length to maximum of lamina, upper sometimes sessile, finely hirsute, often sparsely glandular-haired, lamina ovate, 3–5 partite, mostly quadripartite, lower segment often divided, lobes acute, incised, sinuses narrow to moderate. All leaves setose-pilose especially on veins and margins, glandular hairs sometimes present. Stipules ovate, somewhat acute, membranous, pallid or dusky, ciliate, usually 3–4 mm. long and

3–5 mm. wide. Peduncles vary in length with the lower up to 10 cm. and the upper 1–4 cm. long, glandular-pubescent. Involucre multibracteate; bracts ovate or lanceolate, membranous, pallid or dusky, minutely ciliate, about 1 mm. wide and 1.5 mm. long. Pedicels 1–5, usually dark red, glandular-pubescent, 5–15 mm. long, after anthesis usually retrocurved. Calyx inflated following anthesis and more or less refracted after fruit matures. Sepals ovate, short mucronate, setose, glandular-pubescent, 7–9 mm. long and 2–3 mm. wide. Flowers small, lavender, tending to close early in day. Petals often not spreading, about one and one-fourth times as long as the calyx, obovate with finely pubescent angular base. Stamens ten, the five with anthers alternating with five sterile, scale-like filaments, filaments of fertile stamens dilated nearly to apex and toothed, about one-half calyx length. Small greenish gland at base of each anther-bearing stamen. Pistil densely silvery-villous. Rostrum 5.5–8.5 cm. long with densely appressed short hairs and minute glandular hairs, inner surface barbate, outer surface reddish before ripening; valves with short spreading stiff hairs, bearing twin glabrous foveae which are surrounded by one plica. Seed 3–3.5 mm. long and less than 1 mm. in diameter.

Representative specimens. California: New York Falls, Amador County, *Hansen 502* (Dudley Herbarium, Stanford University); O'Neals, Madera County, *Wagnon 1, 101* (Herbarium University of California).

*Erodium Botrys* f. *montanum* appears to be more common and widespread in California than the species. The latter, however, has been found in almost pure stands on the northeastern edge of North Sacramento, abundant along the state highway from there to Auburn, and scattered along the Bodega road on the outskirts of Sebastopol. Both types are common in the Sierra foothill section and adjacent valley floor of the San Joaquin Valley. During a five-year period at the San Joaquin Experimental Range, the two types combined comprised from 15 to 42 per cent of the plant cover (6, pp. 13–49). On this area they are important components of the cattle diet.

Perhaps the most significant things from a forage standpoint are the big differences in growth habit in the rate of development and time of maturity. This affects the length of the green feed period and, frequently, the amount of forage produced. Plants of *E. Botrys* f. *montanum* normally begin upright growth about two weeks earlier than those of *E. Botrys,* and also mature about two weeks earlier; thus, when they occur together, the season of green forage availability is usually lengthened by about four weeks. This difference in growth and maturity varies from year to year, depending largely on the amount and distribution of rainfall and in part on temperature. In the winter of 1938–39, for example, the rainfall was light and its distribution unfavorable to the best development of both types; as a result, the vegetative development of both types was retarded and the season of available green feed was shortened. On the other hand, in the winter of 1941–42 cold weather and dry spells so restricted the early-growing f. *montanum* that it matured about April 1; favorable weather after this date resulted in the later-growing *E. Botrys* maturing about mid-May. This lengthened the green forage season by about six weeks. Besides greatly expanding the green feed season the combination greatly increased total forage production.

Just where *Erodium Botrys* f. *montanum* originated is a matter of great scientific interest. Are we to assume that it is an emigrant from some source as yet undisclosed to us? Or, is it a California ecotype selected by the environment out of a diverse genetic population which developed from the original importation of *E. Botrys?* Is the Chilean material cited by Brumhard the same as the California material or is it another ecotype? These questions must of necessity be answered before a proper taxonomic evaluation of *E. Botrys* f. *montanum* can be undertaken.

The authors wish to express appreciation to Dr. H. L. Mason, Department of Botany, University of California, for assistance in the identification of the plants and for revision of the initial manuscript, to Dr. Herman Knoche, author of "Flora Balearica," whose remarkable herbarium of Mediterranean plants was made available for our use, and to Mr. W. A. Dayton, of the United States Forest Service, for the use of the drawings in figures 2 and 3 and for the reading of the original manuscript. Thanks are also given to Dr. W. W. Robbins, of the University of California, for helping with the descriptions and for reading the manuscript.

San Joaquin Experimental Range,
O'Neals, California,
January, 1943.

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## REVIEW

*Tertiary Prairie Grasses and Other Herbs from the High Plains.* By Maxim K. Elias. Geological Society of America, Special Papers, number 41. 176 pages, 6 tables, 7 plates. 1942.

The student of living plants who judges from the title of this monograph that it deals entirely with the fossilized hulls of plants long dead is due for a pleasant surprise. Dr. Elias begins his work with an exhaustive review of modern research in all phases of agrostology, in which he refers not only to the classical authorities on the subject, but in addition to several valuable and little known recent contributions to the ecology and morphology of grasses. He then gives a remarkably thorough description of the morphology and taxonomy of the tribe Stipeae, to which belong nearly all of the fossil grasses described by him. The modern genera and many of their species are carefully treated, and many important new diagnostic characteristics are described. These result from a careful comparative study and a penetrating analysis of one of the most complex and diverse series of structures in the grasses, the fruiting lemma or hull of the Stipeae.

Based on this study, Dr. Elias presents a new division into sections of the genus *Stipa,* one of the largest and most diverse of the entire family Gramineae. The nine sections recognized by him may have to be somewhat modified, and more may have to be added as our knowledge of the details of the morphology of the various species becomes more complete, but there is no doubt that Dr. Elias' system is by far the nearest approach to a natural one that has yet been achieved. It will be a fundamental basis for all future work on *Stipa.* Every botanist interested in the grasses should read carefully the first part of this work.

After having spent 72 of the 146 pages of text on this study of living grasses, Dr. Elias occupies a large part of the remainder with a careful description of the large series of beautifully preserved fossil fruits of Gramineae and Boraginaceae, which he has discovered and collected during the past ten years on the plains of Nebraska, Kansas, and adjacent states. Their age, as determined by a careful analysis of the geological formations in which they occur, is late Tertiary, principally late Miocene to middle Pliocene. Most of them are referred to the fossil genus *Stipidium,* considered closely related and directly ancestral to the modern *Stipa.* There are, however, a number of species of the anomalous fossil genus *Berriochloa;* one of another extinct genus, *Paleoeriocoma,* perhaps ancestral to the modern *Oryzopsis hymenoides;* and one of the modern genus *Nassella,* of which all of the modern species are confined to temperate South America. This last discovery is obviously of great importance to students of the modern plant geography of the Americas. In addition to these representatives of the tribe Stipeae, the author describes the fruits of one fossil species of *Panicum*, one of *Setaria*, and refers to the new fossil genus, *Clementsiella*, a fossil species previously described as *Stipa laminarum*. In the Boraginaceae, five species are included, two of them belonging to extinct genera related to the modern *Anchusa* and *Lithospermum*, and three to the modern genus *Krynitzkia*. The original descriptions of many of these species were published by Dr. Elias in earlier papers.

The collection of fossils of the tribe Stipeae is, so far as this reviewer is aware, much the most complete of any series of herbaceous Angiosperms known from any locality. What is more important, the part preserved, the fruiting lemma, is precisely the one which shows the most valuable diagnostic characteristics for the modern species of the tribe. For these reasons, Dr. Elias' contribution to our knowledge of the evolution of this group is unique.

With such fine evidence at hand, Dr. Elias is naturally tempted to reconstruct the phylogenetic history of the entire tribe. It is in this phylogeny that he is on his weakest ground. It is based on two assumptions. In the first place, nearly all of the fossils are referred to an extinct genus, *Stipidium*, although on the basis of the parts preserved they are indistinguishable in all characteristics except size from fruiting lemmas of modern species of the genus *Stipa*. The fossil genus is separated from the modern one because its awn is believed not to have been indurated as are the awns of modern *Stipa* species. This is because no awns or parts of them have been found in the fossil deposits, although thousands of lemmas are known. However, this is only indirect evidence, and one cannot be certain that awns like those of modern *Stipa* species would become preserved and silicified as are the lemmas. In this connection, it is significant to note that although the stems and leaves of *Stipa* are often rather hard and tough, these have not been preserved either. There is, therefore, only indirect evidence that *Stipidium* and *Stipa* are distinct genera, a conclusion which forms the basis of Dr. Elias' belief, as expressed in the chart at the end of his work, that the modern genus *Stipa* originated as recently as the end of the Pliocene epoch. This hypothesis does not agree with evidence from the distribution of living species of the genus, since *Stipa* is represented by numerous diverse species in all continents except Africa, and there are affinities between species which indicate past intermigrations, not only between Eurasia and North America, but also between North and South America and between South America and Australia. The latter connection, which appears to indicate a former Antarctic distribution for certain species of the genus, is strong circumstantial evidence that *Stipa* was already well developed in the middle or even the early part of the Tertiary period.

The second assumption, that the species found in the fossil record of the high plains demonstrate the principle lines of evolution in the tribe Stipeae, is equally open to question. At present, only a small proportion of the species of this tribe occur in steppe or prairie grass formations, and these do not include the species which are the least specialized morphologically, and might therefore be looked upon as the most primitive modern forms. Furthermore, many of these more primitive species have only weakly indurated lemmas, which would probably not be preserved as fossils. In addition, the author gives convincing evidence of the migration of some of the species into the area, as well as their sudden disappearance, apparently through migration away from the region of the fossil deposits. The reader, therefore, cannot help thinking that much of the evolution of the tribe Stipeae during the Miocene and Pliocene periods took place outside of the Great Plains area, and that some of the more recent fossil species evolved not from earlier species of the same region, but from species living elsewhere. This seems particularly likely in the case of the two Pliocene species *Paleoeriocoma Hitchcocki* and *Nassella amphora.* For this reason, some of the evolutionary trends postulated by Dr. Elias must still be regarded as hypothetical and based on indirect evidence. It is to be hoped that paleobotanists will make discoveries similar to those of Dr. Elias elsewhere in the world, so that a nearer approach to a complete distributional picture of the fossil members of this tribe can be obtained.

There are, unfortunately, a few minor nomenclatorial discrepancies in the monograph. For instance, *Stipidium* sect. *Parastipidium* (p. 87) is recognized as a separate genus in the chart, Plate 17. Similarly, *S. variegatum* modification *Dartoni* (p. 83) is referred to on p. 116 as *S. Dartoni,* while *S. Schereri* mut. *marslandense* (p. 88) appears in the chart as *Parastipidium marslandense.* These errors apparently reflect the natural changes of opinion which the author underwent during his pioneer work on this difficult group, and could perhaps have been avoided by more careful editing.

The student of living plants can only hope that this outstandingly careful, painstaking, and original monograph is the forerunner of still further discoveries by Dr. Elias along the same lines, and that other paleobotanists will follow his lead, and give us a more and more complete fossil record of at least this group of herbaceous angiosperms.—G. L. STEBBINS, JR., Division of Genetics, University of California, Berkeley.